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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :
Hiroshi FUKUMOTO, et al. : EXAMINER: KIM, C.
SERIAL NO: 09/750,664 :
FILED: January 2, 2001 : GROUP ART UNIT: 3752
FOR: LIQUID SPRAYER :

#15/appeal
Brief
11/13/03
N. Brewer

APPEAL BRIEF UNDER 37 C.F.R. § 1.192

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SIR:

In response to the Final Office Action dated March 4, 2003, and the Advisory Action dated May 13, 2003, the Appellants herein appeal the final rejection of Claims 1-3.

I. REAL PARTY IN INTEREST

The real party in interest is Mitsubishi Denki Kabushiki Kaisha of Tokyo, Japan.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 4-11, 17, and 18 are pending and have been withdrawn from consideration.

Claims 1-3 are active and are finally rejected.

IV. STATUS OF AMENDMENTS

All amendments have been entered.

V. SUMMARY OF THE INVENTION

The present invention is directed to a liquid sprayer for spraying liquid on an object. The liquid sprayer can be used, for example, on an inkjet head of a printer. An inkjet head sprays ink on a printing paper so that the ink adheres to the printing paper. A desired pattern can be printed on the printing paper by controlling the spray timing and the relative positional relationship between the inkjet head and the printing paper. The sprayed ink tends to float in the area between the inkjet head and the printing paper before the ink reaches the paper, and thus there is a high possibility of the ink adhering to undesired positions on the paper. Accordingly, the invention improves the resolution of the desired printed pattern by providing a liquid sprayer that precisely controls the range of liquid adhering to the object.

According to a feature of the invention, a liquid sprayer is provided with a liquid holder exposing a liquid surface of conductive liquid sprayed on an object, and a field applier forming an equipotential surface convexed with respect to the liquid surface of a conductive liquid sprayed on an object. For example, in the exemplary embodiment depicted in Figure 1, an inkjet head 101 is provided as a liquid sprayer and a printing paper 200 is provided as an object. The inkjet head 101 includes a conductive nozzle plate 3 and stores a conductive ink 21. The nozzle plate 3 has a nozzle hole 31 that exposes a liquid surface 21a of the ink 21. A back plate 4 is provided at a position opposite to the nozzle hole 31, such that the printing paper moves between the nozzle hole 31 and the back plate 4.

A dc voltage source 5 supplies different potentials to the nozzle plate and the back plate 4. Referring to Figure 1, the dc voltage supplies a positive potential to the nozzle plate 3 and a ground potential to the back plate 4. Thus, a potential gradient (electric field) is applied by the dc voltage source 5 between the nozzle plate 3 and the printing paper 200, as shown by an equipotential surface group 51 (appearing as equipotential lines in Figure 1). The nozzle plate 3 is a conductor and the ink 21 is also conductive, and hence the sprayed liquid particle group 7 is charged. The electric field formed between the nozzle plate 3 and the back plate 4 urges and accelerates the charged liquid particle group 7 to adhere to the printing paper 200.

VI. ISSUES

The issues to be considered in this appeal are whether Claims 1-3 are indefinite under 35 U.S.C. 112, second paragraph, and whether Claims 1-3 are anticipated by U.S. Patent No. 4,046,074 (Hochberg et al.).

VII. GROUPING OF CLAIMS

Claims 1-3 stand or fall together.

VIII. ARGUMENT

Rejections Under 35 U.S.C. 112, Second Paragraph

All of the claims recite a liquid sprayer provided with a liquid holder exposing a liquid surface of conductive liquid sprayed on and object, and a field applier forming an equipotential surface convexed with respect to the liquid surface of a conductive liquid sprayed on an object.

The Official Action dated March 4, 2003, rejects the phrase “a field applier forming an equipotential surface” in Claim 1 as being indefinite. The Examiner asks “what is the ‘equipotential surface’?” (Page 2, item 3, of the Official Action dated March 4, 2003.) In the Advisory Action dated May 13, 2003, the equipotential surface is equated with the surface of an electric field. However, the Appellants note that equipotential surface is not the same as an electric field line, but rather electric field lines extend in a direction perpendicular to the equipotential surface at all points along the equipotential surface.

The Appellants note that the phrase “equipotential surface” is known in the art, as is evident from a quick search of U.S. patent publications¹ and a quick internet search. Additionally, equipotential surfaces are described in a discussion of Laplace’s Equation in Van Nostrand’s Scientific Encyclopedia, Revised Eighth Edition², which is further evidence that such equipotential surfaces are known in the art. U.S. Patent No. 6,624,589, which was found

¹ A search conducted on the U.S. Patent and Trademark website of the terms “equipotential” and “surface” in U.S. patents from 1976 to September 23, 2003, found 2,553 patents that used both words in the specification (see, e.g., the equipotential surface 6 in Figure 3 of U.S. Patent No. 6,624,589), 59 patents that used both words in the Abstract, and 2 patents that used both words in the title (U.S. Patent No. 4,199,715 entitled Method and apparatus for defining an equipotential line or surface in the earth's atmosphere and measuring the misalignment of a selected line or plane relative to an equipotential line or surface; and U.S. Patent No. 5,880,937 entitled Electrical circuit arrangement having equipotential surface for reduced high-frequency interference (the concept of the phrase “equipotential surface” used in this reference deviates from the broader general definition of this phrase used in the present application)).

² Van Nostrand’s Scientific Encyclopedia states “We shall here cite two familiar physical examples to which Laplace’s equation applies; there are many others. 1. Consider a region of space in which there is an electric field (due to electric charges in the vicinity) but no free electricity, that is, no such space charge as exists in a vacuum tube in operation. At any point in this space there is an electric potential, which varies with the position of the point and is therefore a function of its coordinates. It is shown in electrostatic theory that if the potential satisfies Laplace’s equation, it is possible to trace the lines of force and equipotential surfaces in the region, by means of special solutions of Laplace’s equation, called harmonic functions, which satisfy the ‘boundary conditions’ imposed by the arrangement of the neighboring charges. As to which form of the equation is to be used, this depends upon which system of coordinates is most conveniently adapted to the shape and arrangement of the charged bodies.”

during a search of U.S. patent documents containing the terms “equipotential” and “surface,” describes equipotential surfaces 6 depicted in Figure 3. The Appellants submit that the phrase “equipotential surface” is known in the art as surfaces that have the same potential at every point on the surface. Equipotential surfaces are present at infinitesimal intervals in the space from the surface of the nozzle plate 3 to the back plate 4 of the present invention. Figure 1 of the present application depicts several equipotential surfaces, which are grouped together using reference numeral 51 and described as a group of equipotential surfaces or an equipotential surface group. The Appellants submit that the phrase “equipotential surface” is well known in the art and the phrase’s use in Claim 1 would be clear to one of skill in the art.

The Official Action dated March 4, 2003, rejects Claim 1 as being indefinite for containing a double inclusion based upon the phrase “field applier forming an equipotential surface” and the phrase “liquid holder.” The Appellants note that the present application describes a non-limiting embodiment of a field applier that includes a nozzle plate (3), a back plate (4), and a dc voltage source (5). (See page 7 lines 17-25, of the specification.) The Appellants further note that the specification describes a non-limiting embodiment in which a portion of the field applier, namely nozzle plate (3), also serves as a portion of the liquid holder. However, the present invention is not limited to such an embodiment. The present invention as recited in Claim 1 additionally encompasses embodiments where the nozzle plate of the field applier and liquid holder are constructed of different structures, as would be clearly evident to one of ordinary skill in the art based upon the teachings of the present invention. The Appellants submit that it is improper to conclude that a claim is indefinite merely because it covers plural embodiments. The present claim language would clearly advise the public of the

scope of the claim, and thus the Appellants submit that Claim 1 is definite under 35 U.S.C. 112, second paragraph. As stated in MPEP 2173.05(o), “[t]here is no *per se* rule that ‘double inclusion’ is improper in a claim.” (Citing *In re Kelly*, 305 F.2d 909, 916, 134 USPQ 397, 402 (CCPA 1962).) The court in *In re Kelly* stated that “[t]he governing consideration is not *double inclusion*, but rather is what is a reasonable construction of the language of the claims.” (Emphasis in the original.)

The Appellants submit that the scope of Claim 1 is clear. Namely, since Claim 1 is not limited to a configuration in which the liquid holder is part of the field applicator, then Claim 1 encompasses both a liquid sprayer in which a portion of the liquid holder is also a part of the field applicator, as well as a liquid sprayer in which the liquid holder and the field applicator are distinct structures. Such an interpretation is clear from the language of Claim 1. The Appellants submit that the fact that an element serves as both a part of a liquid holder and a part of a field applicator does not render the claim indefinite. Additionally, the fact that the claim also encompasses additional configurations that one of skill in the art would easily recognize based on the disclosure in the specification, does not render the claim indefinite. (See 2173.04 - Breadth Is Not Indefiniteness.) (Note that the Appellants need not disclose every possible permutation of the invention, as such a requirement would be unduly burdensome. The enablement requirement is whether one skilled in the art could make or use the invention from the disclosures in the application without undue or unreasonable experimentation, which is clearly satisfied in the present case. (See MPEP 2164.01.)).

The Official Action seems to suggest that Claim 1 should be amended either define a liquid sprayer in which a portion of the liquid holder is also a part of the field applier, or a liquid sprayer in which the liquid holder and the field applier are distinct structures, but not both. The Appellants submit that requirement is unnecessary for the clear understanding of Claim 1 and is unwarranted and unduly limiting. Accordingly, the Appellants respectfully request a finding that Claim 1 is definite.

With regard to the indefiniteness rejection of Claim 2, the Appellants note that Claim 2 specifically states that the liquid holder comprises a conductive nozzle plate. Accordingly, there is no “double inclusion” of a liquid holder in Claim 2, but rather the conductive nozzle plate is recited as an element of the liquid holder. Therefore, the Appellants respectfully submit that Claim 2 is definite under 35 U.S.C. 112, second paragraph.

With regard to the indefiniteness rejection of Claim 3, the Appellants note that the equipotential surface is not necessarily in reference to any part of the conductive nozzle plate.

The Appellants submits that the equipotential surface is formed by the field applier in the electric field, an embodiment of which is depicted in Figure 1 as an equipotential surface of the equipotential surface group (51). Accordingly, Claim 3 does not include a “double inclusion.” Therefore, the Appellants respectfully submit that Claim 3 is definite under 35 U.S.C. 112, second paragraph.

Rejections Under 35 U.S.C. 102(b) As Anticipated by Hochberg et al.

All of the claims recite a liquid sprayer provided with a liquid holder exposing a liquid surface of conductive liquid sprayed on and object, and a field applier forming an equipotential surface convexed with respect to the liquid surface of a conductive liquid sprayed on an object. The Official Action dated March 4, 2003, rejects the claims as being anticipated by Hochberg et al. The Official Action cites common electrode 42 and marking electrode 40 for the teaching of the “field applier,” the printing head 30 for the teaching of the “liquid holder,” and printing support medium 12 for the teaching of the “object.” The Official Action indicates that “the concaved surface, as shown in Figure 2A, over the printed letters, forms an equipotential surface convexed with respect to the liquid surface.” (Page 4, lines 2-4, of the Official Action.)

Hochberg et al. describes a non-impact printing system for making in-situ an energy sensitive surface on a passive support medium from at least two materials which in combination render the surface energy sensitive. The Appellants submit that the marking electrode 40 and the common electrode 42 of Hochberg et al. are not disclosed as being capable of forming an equipotential surface convexed with respect to a liquid surface exposed by the printing head 30.

For purposes of illustration and not limitation, the present application describes an embodiment in Figure 1 in which a field applier is provided that forms an equipotential surface (one surface of the grouping 51 of equipotential surfaces) that has a convex shape with respect or in relation to a liquid surface 21a of a conductive liquid 21. The Official Action refers to Figure 2A of Hochberg et al. as showing a concave surface (page 4, lines 1-4), however, the only concave surface shown in Figure 2A is a concave surface of the printing head (30). Figure 2A does not depict the surface of the conductive liquid sprayed, which may or may not parallel

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the surface of the printing head. Additionally, Hochberg et al. does not depict equipotential surfaces formed by the marking electrode 40 and the common electrode 42. Thus, since neither the equipotential surfaces nor the surface of the liquid are described or depicted, Hochberg et al. does not disclose an equipotential surface that is convexed with respect to a liquid surface of conductive liquid.

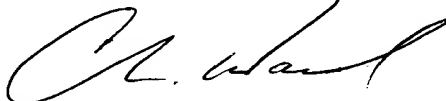
Accordingly, the Appellants submit that Hochberg et al. does not anticipate Claim 1 of the present application, which expressly recites a field applier forming an equipotential surface convexed with respect to the liquid surface.

Claims 2 and 3 are considered allowable for the reasons advanced for Claim 1 from which they depend.

The Appellants therefore respectfully submit that all of the claims are patentable, and so requests that the final rejection be REVERSED.

Respectfully submitted,

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APPENDIX

1. A liquid sprayer comprising:

a liquid holder exposing a liquid surface of conductive liquid sprayed on an object; and

a field applier forming an equipotential surface convexed with respect to the liquid surface of a conductive liquid sprayed on an object.
2. The liquid sprayer according to claim 1, wherein said liquid holder comprises a conductive nozzle plate, supplied with a potential different from that for said object, said conductive nozzle plate having:

a first opening exposing said liquid surface, and

a second opening wider than said first opening and arranged closer to said object than said first opening.
3. The liquid sprayer according to claim 2, wherein said conductive nozzle plate further comprises:

a concave portion provided between said first opening and said second opening and concaved with respect to said object.